

Economic Benefits of a New Beach Water Quality Monitoring Method

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Do Faster Test Methods Benefit Swimmers?

Pollution at the nation's swimming beaches causes diseases for swimmers and a loss of desirable recreation opportunities when beaches are closed or when water quality hazard warnings are posted. Microbial contamination often arises after rainstorms, which can cause sewage treatment plants to overflow or wash contaminants directly from streets and yards into surface water. Although EPA and the states are trying to address the contamination problems at their sources, it is also necessary to warn swimmers to avoid contact with water where disease-causing pathogens might be present.

Many states close or post warnings at beaches when water quality tests show unacceptably high levels of pathogens that increase the risk of swimmers contracting gastrointestinal illnesses. Water quality monitoring methods currently in use require up to 24 hours for results to become available. During the time between testing, obtaining results, and beach closure, swimmers may be at risk of becoming ill due to exposure to unacceptable water quality. Researchers at EPA's Office of Research and Development have developed a new DNA-based water quality test that provides same-day results and can be used to reduce the risk of waterborne illness among beachgoers. This research and development project is part of a national beach research effort by EPA, in collaboration with the Centers for Disease Control and Prevention (CDC).

In this study, we estimate the monetary benefits of switching from the current test method to the new one developed by EPA at two Great Lakes beaches where EPA surveyed beachgoers and monitored water quality with the new method (Beach A and Beach B).



Comparison of Water Quality Test Methods

Current Method

- Test results not available for 24 hours
 - Swimming during this period may increase risk of illness if results indicate beach should be closed or posted
- Beaches often are closed or posted for 2 to 3 days
 - EPA's analyses show water quality is safe after 24 hours in most instances

New Method

- Results available in as little as 2 hours
 - Allows real-time assessments of water quality in the early morning
 - Ability to post advisories or close beaches before swimmers or waders are exposed to pathogenic organisms
- Permits beaches to be reopened earlier
 - Increases recreation opportunities for beachgoers
 - Indirect benefits to local economies: increased revenues to local government agencies and businesses (not assessed here)

Water Quality

Good	Bad	Good	Good
Beach Open	Open But Should Be Closed Closed Closed But Should Be Open	Open	Beach Open
Beach Open	Beach Closed	Beach Open	Beach Open
	Opportunity for Health Benefits	Opportunity for Recreational Benefits	

This Study

We compiled information from a variety of sources to estimate the economic benefits of the new beach water quality monitoring method at the two test sites. Sources include:

- EPA's NEEAR (National Epidemiological and Environmental Assessment of Recreational) Water Study
 - 2003 data for two Great Lakes beaches
 - Intercept survey of beachgoers
 - Water quality testing using both methods on survey days
 - Follow-up survey of beachgoers for data on gastro-intestinal (GI) illnesses
 - Preliminary estimates of exposure-response function from the National Exposure Research Laboratory (NERL) and National Health and Environmental Effects Research Laboratory (NHEERL)
- EPA's BEACON data (BEach Advisory and Closing Online Notification)
 - Available on EPA's "Find Your Beach" Web Site at: http://oaspub.epa.gov/beacon/beacon_national_page.main
 - Gives closure and posting information for participating beaches
- Beach attendance data from two beach authorities
- Rainfall data from the National Oceanic and Atmospheric Administration (NOAA)
- Economic value of impaired water quality warnings
 - Murray and Sohngen (2000)
- Cost-of-Illness data for GI illness
 - Corso, et al. (2003)
- Estimates of cost of test equipment and operation (EPA 2005)

Summary of Preliminary Results

Health Benefits from Avoided Illnesses as Beaches are Posted Sooner

EPA investigators estimated that the annual health benefits from reduced exposure to pathogens as a result of the new test would be about \$138,000 at Beach A in Ohio, and \$64,000 at Beach B in Indiana, for a total health benefit of about \$202,000 per year, in 2005 dollars.

	Beach A, Ohio	Beach B, Indiana	Both Beaches
Total Summer Beach Attendance (est.)	183,243	109,040	292,283
Total Swimmers (est.)	109,946	65,424	175,370
Average Number of Swimmers per Day	2,036	1,212	3,248
Days When Beach Should Be Closed but is Open (est.)	11	4	15
Number of Avoided Cases of GI Illness (est.)	558	261	819
Value of an Avoided GI Case			\$247
Total Health Benefits from Avoided GI Cases			\$202,178

Recreational Benefits from Reopening Beaches Sooner

The benefits to swimmers of reducing water quality advisories at swimming beaches was \$51,000 at Beach A for a reduction of 11 days under advisories and \$11,000 at Beach B for a reduction of 4 days under advisories, for a total of \$62,000 in annual recreational benefits for about 27,000 affected swimmers.

	Beach A, Ohio	Beach B, Indiana	Both Beaches
Days When Beach Should Be Open but is Closed (est.)	11	4	15
Average Number of Swimmers per Day	2,036	1,212	3,248
Value per Swimmer of an Avoided Beach Advisory Day			\$2.28
Economic Value of Avoided Advisories			\$62,113

Combined health and recreational benefits at the two beaches where EPA conducted water quality analysis and beachgoer surveys approximate \$264,000 annually, \$189,000 at Beach A, and \$76,000 at Beach B.

Total Annual Benefits = \$264,000 at Two Beaches

Costs

The new test procedure will require investment in DNA analytical testing equipment and facilities, and the distance between these facilities and beaches will determine the number of beaches that can jointly or singly use this new test equipment. We assume capital equipment can be shared by four beaches within 45 minutes driving distance.

- Costs for New Method: \$6,740 per beach per year
 - Capital costs for new analytical equipment, amortized to provide annual costs
 - Training cost for new analysts
 - Labor costs for sample collection and analysis
- Costs for Old Method: \$5,690 per beach per year
 - Labor costs for sample collection and analysis
- Net cost of \$1,050 per beach per year.

Total Net Annual Costs = \$2,100 at Two Great Lakes Beaches

Conclusion

The new method of DNA-based water quality testing will avoid illnesses for swimmers and increase the benefits of recreational opportunities at Great Lakes beaches. The new method will require substantial capital investment, but can be reduced if beaches share analytical capabilities. Overall, the net benefits (benefits – costs) for the two beaches that EPA surveyed for water quality and illness in 2003 are strongly positive, worth about \$262,000 annually for both beaches combined.

Total Net Annual Benefits = \$262,000 at Two Great Lakes Beaches

Future Directions

In the next phase of this study, we plan to extrapolate the results from the two beaches in the NEEAR study to other Great Lakes beaches. This extension will require additional information on beach visitation for all Great Lakes swimming beaches and actual testing frequency. If this approach is feasible, we will extend it to other fresh water beaches in the U.S. In addition, as results from marine tests now in process become available, we will expand the analysis from freshwater to marine beaches. Also, we may add benefits associated with a lower level of false positives, or the greater accuracy of this test. Finally, using GIS tools, we will calculate the cost-minimizing number of test facilities and their optimal placement.



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